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We have $4m'^2n'^2=4m^2n^2$ .....(5).

Adding (4) and (5), $(m'^2+n'^2)^2=4m^2n^2\left(\frac{4m^2n^2}{(m^2-n^2)^2}+1\right)$

$$\text{or } m'^2+n'^2=\frac{2mn(m^2+n^2)}{m^2-n^2} \ldots\ldots (6).$$

m and n must be selected so as to make (3) and (6) integral.

70. Proposed by CHARLES CARROLL CROSS, Libertytown, Md.

Give methods for decomposing numbers into squares, cubes, or biquadrates, and show that 61×200^3 is the sum of ten cube numbers, and that 844933 is the sum of eleven biquadrates in thirteen different ways. [From *The Mathematical Magazine*, Vol. II, No. 10.]

Comment by the PROPOSER.

Dr. Artemas Martin has written me that he knows of no method of separating a given number into squares, cubes and other powers, except *trial*.

I take the following numbers from *The Mathematical Magazine*.

$61\times200^3=1^3+2^3+4^3+6^3+15^3+46^3+60^3+270^3+500^3+700^3$.

$844933=27^4+20^4+16^4+15^4+12^4+10^4+8^4+7^4+3^4+2^4+1^4$,

$=25^4+24^4+16^4+15^4+8^4+6^4+5^4+4^4+3^4+2^4+1^4$,

$=25^4+24^4+15^4+14^4+12^3+10^4+7^4+4^4+3^4+2^4+1^4$,

$=25^4+22^4+18^4+15^4+14^4+11^4+10^4+6^4+3^4+2^4+1^4$,

$=25^4+21^4+18^4+17^4+14^4+12^4+10^4+6^4+5^4+4^4+1^4$,

$=25^4+21^4+18^4+16^4+15^4+12^4+10^4+9^4+6^4+3^4+2^4$,

$=25^4+21^4+18^4+15^4+14^4+13^4+12^4+10^4+8^4+7^4+2^4$,

$=25^4+20^4+19^4+18^4+14^4+10^4+9^4+7^4+6^4+4^4+3^4$,

$=25^4+20^4+19^4+16^4+14^4+13^4+11^4+10^4+9^4+4^4+2^4$,

$=24^4+23^4+18^4+15^4+14^4+12^4+10^4+9^4+6^4+5^4+3^4$,

$=24^4+21^4+20^4+16^4+15^4+13^4+10^4+7^4+6^4+4^4+1^4$,

$=24^4+21^4+20^4+16^4+15^4+12^4+11^4+8^4+7^4+5^4+2^4$,

$=24^4+21^4+19^4+18^4+15^4+12^4+10^4+6^4+5^4+3^4+2^4$.

MISCELLANEOUS.

64. Proposed by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Science, Chester High School, Chester, Pa.

How many bushels of wheat will a conical bin 8 feet in diameter at base and 12 feet high hold, if part of the bin is cut off by a plane parallel to the side and passing through the center of the base ?

Solution by the PROPOSER.

Let ABC be the cone, DF the plane.

Let $BD=c$, $\tan DBC=\cot FDC=n$, $DC=R$.

$\therefore x^2+z^2=n^2(c-y)^2$ is the equation to the cone.

$x=ny$ is the equation to the plane.

V=volume of cone cut off by plane.

The limits of x are $ny=x_2$ and $n(c-y)=x_1$; of y, 0 and $\frac{1}{2}c$.

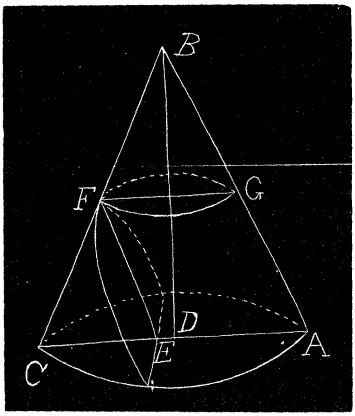
$$\therefore V=2\int_0^{\frac{1}{2}c}\int_{x_2}^{x_1}\sqrt{[n^2(c-y)^2-x^2]}\,dy\,dx$$

$$=\int_0^{\frac{1}{2}c}\{\tfrac{1}{2}\pi n^2(c-y)^2-n^2(c-y)^2\sin^{-1}\left(\frac{y}{c-y}\right)$$

$$-ny\sqrt{[n^2(c-y)^2-n^2y^2]}\}\,dy$$

$$=\tfrac{1}{6}\pi n^2c^3-\tfrac{2}{9}n^2c^3=\tfrac{1}{18}n^2c^3(3\pi-4)$$

$$=\tfrac{1}{18}R^2c(3\pi-4).$$



But $c=12$, $R=4$.

$\therefore V=32\pi-\frac{128}{3}$.

Volume of cone$=\frac{1}{3}\pi R^2c=64\pi$.

$\therefore$ Required vol.$=64\pi-(32\pi-\frac{128}{3})=32\pi+\frac{128}{3}$

$=143.1978$ cubic feet,

$=115.07$ bushels.

Also solved by *P. S. BERG* and *C. C. CROSS*.

[NOTE.—In the figure, the point E should coincide with D. ED. F.]

65. Proposed by F. P. MATZ, D. Sc., Ph. D., Professor of Mathematics and Astronomy, Irving College, Mechanicsburg, Pa.

Show that the path of a projectile moving with a constant velocity is an inverted catenary of equal strength.

No solution has yet been received.

PROBLEMS FOR SOLUTION.

ARITHMETIC.

102. Proposed by ALOIS F. KOVARIK, Professor of Mathematics, Decorah Institute, Decorah, Iowa.

A's age is to B's as 2:3. 20 years from now their ages will be to each other as 4:5. What are their ages, respectively ?

103. Proposed by WALTER H. DRANE, Graduate Student, Harvard University, 65 Hammond Street, Cambridge, Mass.

Find proceeds of a note discounted at a bank for 10 years at 10%. What is the meaning of the result ?

*** Solutions of these problems should be sent to B. F. Finkel not later than January 10.

ALGEBRA.

92. Proposed by ELMER SCHUYLER, High Bridge, N. J.

Given $x^2-yz=1$; $y^2-xz=2$; $z^2-xy=3$. Find x, y, and z.